Docket No.: J4-K10

#8 Subspec
DNwL 8/14/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Moon-Soo Yoo	)	
		)	
Serial Number :	09/735,770	)	Examiner: Parekh, Ankur
		)	
Filed:	December 13, 2000	)	Group Art Unit: 3681
		)	
For:	Apparatus for Changing the Speed of Bicycles	)	South Pasadena, California August 6, 2002

OK to enter AP 8/21/02

REWRITTEN SPECIFICATION

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

In response to the Office Action of March 6, 2002 in respect to the above-identified Application, the Specification has been rewritten in marked-up and clean form, both of which are attached hereto. The undersigned certifies that no new matter has thereby been introduced.

Respectfully submitted,

Stephen J. Koundakjian
Registration No. 25,427

Post Office Box 758
South Pasadena, California 91031
Tel: (626) 799-1115
Fax: (626) 799-5373
Email: sjkip@ix.netcom.com

CERTIFICATION UNDER 37 C.F.R. 1.10

I hereby certify that the accompanying REWRITTEN SPECIFICATION is being deposited with the United States Postal Service on the date indicated below, in an envelope designated as "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10, Mailing Label Number ET847117180US, addressed to the Assistant Commissioner for Patents, Washington, DC 20231.

Sara A. Koundakjian — August 6, 2002
Sara A. Koundakjian (date)

APPARATUS FOR CHANGING THE SPEED OF BICYCLES

Background of the Invention

Technical Field

The present invention relates to an apparatus for changing the speed of bicycles and other vehicles using sprockets and chains. M[m]ore particularly, the invention [as] is a transmission [for bicycles and something using sprockets and chains, to an] apparatus for changing the speed of] such vehicles [bicycles that changes speed of bicycles] using inner gears [inside] within a rear wheel hub and controlling the inner gears with controllers mounted on a hub shaft, so that the bicycle or other vehicle has a good appearance, [the manipulation of] changing speed is convenient, the effect [of the manipulation takes place] occurs immediately after a[n] speed-changing operation, little [noises occur] noise occurs when changing [the] speed [of bicycles], and [the steps of] the number of speed level steps [are] may easily be [extensible] increased.

Background Art

In general, [an] the apparatus for changing speed ([or] i.e., [a] the transmission) is installed on a bicycle[s]. However, [and] in some [other] cases, the transmission [is] may be installed on wheelchairs and toy cars using pedals.

[As] In a conventional bicycle transmission [for bicycles], sprockets having [diverse] differing diameters, are mounted, respectively, on the side of the middle frame and rear wheel, and a chain [which] connects the front and rear sprockets. [So the] The speed is changed by changing the coupling of the sprockets.

But the conventional bicycle transmission [for bicycles] has a few drawbacks in that it is too bulky because of the many large sprockets [are mounted], and [moreover,] noise[s] and impacts [take place] occur when changing [the] speed [of bicycles].

As a [counterproposal to] means of overcoming these [the] drawbacks, [there is] an inner gear-type transmission [that is] may be installed in [a] the rear wheel hub. In such an [The] inner gear-type transmission [is such a device that] small gears and a controlling means are disposed in a hub shell, so that the bicycle speed [of bicycles] is changed by changing the gear tooth['s] ratio thereof.

[As an example of the] Illustrative of an inner gear-type transmission [, an inner gear-type transmission hub for bicycles] is [disclosed by] Japanese laid open patent publication No. Hei7-10069, which discloses an inner-gear type transmission hub for bicycles.

The prior art inner gear-type transmission, as shown in FIG. 1, [comprising] comprises a speed changing portion 10, [which is] composed of a hub shaft 6, a driving body 2, a freely rotatable hub 1 [freely rotatable], at least two sun gears 12, 13 engaging [with] at least two [teeth] tooth portions 11a, 11b, and a speed-change controlling portion 20. The latter controls [controlling] the speed changing portion 10 by transforming the rotational state of [a plurality of] the sun gears [12, 13, which]. The speed changing portion is composed of a one-directional driving means 7 that is installed between the driving body 2 and the hub 1, [enables] enabling the hub 1 to rotate [precedently] over the driving body 2. [, a] A ring-gear portion 1c is fixed to the hub 1 engaging [with] planetary gears 11.

[So] The [the] transmission can change the bicycle speed [of bicycles to] into three states: [, that is,] a low speed state [that] , in which the driving force of the driving body 2 is transferred to the hub 1 via the one-directional driving means 7 by controlling of the speed-change controlling portion 20[,]; and at least two high speed-states [that] , in which the driving force of the driving body 2 is transferred to the ring-gear portion 1c via the planetary gears 11, resulting in a [with] speed increase.

[Namely] In other words, when it is in the low speed state, the driving force of the driving body 2 is transferred directly to the hub 1 by the one-directional driving means 7. [But] However, when [a] the rider controls the speed-change controlling portion 20, one of the sun gears 12, 13 is fixed selectively. The driving body 2 is rotating, in this state, the ring-gear portion 1c [is] rotating [with] by planetary gears 11 [being engaged with] engaging the selectively fixed sun gear.

In this case, the speed is controlled by the [tooth's] tooth ratio among the fixed sun gear, the planetary gears 11 and ring-gear portion 1c. Because the fixed sun gear has [much] many more teeth than the planetary gears 11, the speed of the planetary gears 11 revolving around the fixed sun gear exceeds the speed of one-directional driving means 7, thus yielding [therefore,] the high speed state [is possible].

[The operation of the speed-change controlling portion 20 is, as] As shown in FIGs. 2A to 2C, the prior art speed-change controlling portion 20 is operated by pawls 12a, 13a mounted on the side of the sun gears 12, 13, with a protrusion for fixing gears 6a, and a controlling sleeve 21. [That is, each] Each step of changing speed is operated by [fixing the sun gear] using the pawls 12a, 13a [with being fixed] to fix the sun gears to the controlling sleeve 21 or [by releasing] to release the sun gears from the pawls 12a, 13a.

In [a] the low speed state, as shown in FIG. 2A, the two pawls 12a, 13a are released from

the controlling sleeve 21 by the protrusions [for] of the fixing gears 6a. But in the first high speed state, as shown in FIG. 2B, because one pawl 12a is [fastening] fastened to the controlling sleeve 21, one sun gear 13 is rotatable. So the larger diameter portion of the planetary gears 11 [is engaging with] engages the fixed sun gear 12.

[In] On the other hand, when the other pawl 13a is [fastening] fastened to the controlling sleeve 21, the other sun gear 12 is rotatable, so that the smaller diameter portion of the planetary gears 11 [is engaging with] engages the fixed sun gear 13, as shown in FIG. 2C. [That is to say, it] This is the second high speed state.

However, in [such an above speed controlling type] a speed control apparatus as described above, because the two pawls 12a, 13a are installed [on the] opposite [side to each other] one another, there is a drawback[. That is, when]: When a rider operates a lever in order to change the speed of [a] the bicycle, the effect of this operation is delayed until one of the pawls 12a, 13a is [in effect] activated. [To the most] Typically, the effect of the operation [takes place] occurs only after the wheel makes a half revolution.

While the above drawback could be [settled a little] resolved somewhat by [comprising] providing more pawls, [it is needed that] this would necessitate changing the shape of the controlling sleeve 21 [must be changed]. But because it [is also needed that] would also be necessary to change the shape of the protrusions [for] of the fixing gears 6a [is to be changed], [it is confined to increase] the number of pawls could not easily be increased.

Even when the pawls are not in operation, friction always [takes place] occurs between the pawls 12a, 13a and the controlling sleeve 21. [And the] This friction [also] causes noise[s] and abrasion, which is also a [weak point] negative factor.

Moreover, [in case of comprising] if more [steps of] speed change steps [by comprising] are offered by providing more planetary gears, the above drawbacks become more serious.

Brief Summary of the Invention

It is an object of the present invention to provide an apparatus for changing the speed of bicycles, which changes speed [of bicycles] by using inner gears inside a rear wheel hub and controlling the inner gears with controllers mounted on a hub shaft. [, so that] Accordingly, the bicycle has a good appearance, [the manipulation of] changing speed is convenient, the effect of the speed change operation [manipulation takes place] occurs immediately [after an operation], little noise[s] occurs [when changing the speed of bicycles] during the operation, and [the steps of] additional speed level steps [are] may easily [extensible] be provided.

According to the [first aspect of the] above object, there is provided an apparatus for changing the speed of bicycles, [the apparatus] comprising: a driven sprocket receiving the driving force of a driving sprocket; a speed controlling portion, [which is] comprising a carrier [that is] fixed to one side of the driven sprocket, containing a plurality of planetary gears [is installed] having ratchet-teeth formed along their inner circumferences; at least two sun gears [that are] engaging [with] each step of the planetary gears [ratchet-teeth is formed along inner circumference] a ring gear [that is] engaging with the other sides of the planetary gears; an output portion, [which is] comprising a hub shell transferring the driving force to [a] the rear wheel by means of the carrier and the ring gear; a clutch means, mounted between the carrier and hub shell, and the ring gear and the hub shell, which selectively mediates [that is mediating] the driving force [selectively with being mounted between the carrier and the hub shell, and the ring gear and the hub shell]; and a speed-change controlling portion.

The latter [which is comprising] comprises a hub shaft having a pawl-positioning portion; at least two set of pawls [which are] engaging with or releasing [with] from the ratchet-teeth of the [at least] two or more sun gears; a pawl-controlling ring [that is] controlling the position of the [at least] two or more sets [set] of pawls; a transforming disk having a groove along its outer circumference, [that] with a hooking portion [is formed] at a certain position [on the outer circumference] thereon, in order to transform the position of the pawl-controlling ring via a mediating portion; a spring [that is] for restoring the position of the transforming disk to its original position; and a spacing portion enabling the transforming disk to rotate freely.

Brief Description of the Drawing

FIG. 1 is a partial sectional view showing a transmission hub for bicycles of the prior art;

FIGs. 2A to 2C are schematic views of a speed-change controlling portion in each speed step of a transmission hub for bicycles of the prior art;

FIG. 3 is a sectional view of the speed changing apparatus of the present invention;

FIG. 4 is a sectional view [cut] along A – A' [line] of [the] FIG. 3;

FIG. 5 is a sectional view of the speed-change controlling portion of the present invention;

FIG. 6 is a perspective view of the speed-change controlling portion of the present invention;

FIG. 7 is an exploded perspective view of the speed-change controlling portion of the present invention;

FIG. 8 is a sectional view of the speed changing apparatus of the present invention according to another embodiment;

FIG. 9A is a schematic view of the speed-change controlling portion of the present invention in its low speed state;

FIG. 9B is a schematic view of the speed-change controlling portion of the present invention in its mid speed state;

FIG. 9C is a schematic view of the speed-change controlling portion of the present invention in its high speed state;

FIG. 10 is a section view of the speed changing apparatus of the present invention according to the third embodiment; and

FIG. 11 is a section view of the speed changing apparatus of the present invention according to the fourth embodiment.

Detailed Description of the Preferred Embodiments

As shown in FIGs. 3 and 4, the present [invention of an] apparatus for changing the speed of bicycles comprises, [largely] principally, a driven sprocket 100 receiving the driving force of a driving sprocket (not shown), a speed controlling portion, an output portion, and a speed-change controlling portion.

[Said] The speed controlling portion [is comprising] comprises a carrier 210 that is fixed to one side of the driven sprocket 100, [and] a plurality of installed planetary gears 220 [is installed], at least two sun gears 231, 232 [that is] engaging each step of the planetary gears 220, [and] having ratchet-teeth 231a, 232a [are] formed along their inner circumferences, and a ring gear 240 [that is] engaging with the other sides of the planetary gears 220.

[And the] The output portion [is comprising] comprises a hub shell 310, which transfers [transferring] the driving force to [a] the rear wheel by means of the carrier 210 and the ring gear 240[,]; and a clutch means 320, mounted between the carrier 210 and the hub shell 310, and the ring gear 240 and the hub shell, that [is mediating] selectively mediates the driving force [selectively with being mounted between the carrier 210 and the hub shell 310, and the ring gear 240 and the hub shell 310].

The speed-change controlling portion [is comprising] comprises a hub shaft 410 having a pawl-positioning portion 411[,]; at least two set of pawls 421, 422 [which are] engaging with or releasing [with] from the ratchet-teeth 231a, 232a of the [at least] two or more sun gears 231, 232[,]; a pawl-controlling ring 430 [that is] controlling the position of the [at least] two or more

sets of pawls 421, 422[,]; a transforming disk 450 having a groove 451 along its outer circumference and a hooking portion 452 [is formed on] at a certain position [along the outer circumference] thereon, in order to [transforming] transform the position of the pawl-controlling ring 430 via a mediating portion 440[,]; a spring 460 [that is] for restoring the position of the transforming disk 450 to its original position[,]; and a spacing portion 470 enabling the transforming disk 450 to rotate freely.

In this embodiment, the clutching means 320 [is comprising] comprises a clutch ring in which a group of pins is [formed] positioned, and a sloping portion 241 [is] formed on the outer surface of the carrier 210 and the ring gear 240. [So] Thus, the carrier 210 (or the ring gear 240) and the hub shell 310 rotate, as [like] a [one] single body, [with] being fixed by the relative displacement of the clutch ring.

[But according to] Under certain circumstances, [a] ratchet-teeth and pawls can replace the clutch ring and the sloping portion 241.

As shown in FIGs. 5 and 6, on the inner surface of the pawl-controlling ring 430, grooves are formed symmetrically with respect to the center point in order to control the position of the pawls 421, 422.

The grooves [are] consist[ed] of a [couple] pair of [a] sloping grooves 431 and a [couple] pair of [an] angular grooves 432[,]. [and the] The sloping grooves 431 and the angular grooves 432 are formed alternatively on the inner surface of the pawl-controlling ring 430.

While the grooves are not formed [as] at the same intervals, the pawls 421, 422 are mounted in the pawl-positioning portion 411 [with] at the same intervals, so that only one set of pawls is controlled selectively and smoothly.

[And the pawls 421, 422 are, as] As shown in FIG. 7, the pawls 421, 422 [composed of] comprise a sag portion 421a, 422a [positioning] positioned inside [of] the pawl-controlling ring 430 and a stopper portion 421b, 422b [that is] engaging with or releasing [with] from the ratchet-teeth 231a, 232a, which are formed along the inner circumferences of the sun gears 231, 232.

The pawl 422, which is [positioning] positioned relatively far from the pawl-controlling ring 430, [is] further [comprising] comprises an extended portion 422c that is thinner than the pawl body, so that it prevents the pawl 422 from engaging [with] other elements.

[From now on,] Hereinafter, for convenience, the pawl 421 [denotes] will denote a first pawl that [is engaging with] engages the sun gear 231 ([also, denotes] the latter denoted as a first sun gear), which is near [to] the pawl-controlling ring 430[, and the pawl]. Pawl 422 [denotes]

will denote a second pawl that [is engaging with] engages the sun gear 232 ([also,] denoted as a second sun gear)[, for convenience].

[The] As shown perhaps more clearly in FIG. 7, the mediating portion 440 [is comprising] comprises a splined groove 433 that is formed on one side of the pawl-controlling ring 430, a connecting portion 441a [that is] engaging [with] the splined groove 433 [and a] by means of the coupling [groove] tongue 441 formed therein, and a pork ring 442 that is installed in the [coupling] central grooves of the connecting portion 441, mediating the rotational force [with] by [being] engaging [with] a splined portion 453 formed in the transforming disk 450.

[Also, the] The spacing portion 470 [is comprising] comprises a sustaining portion 471 sustaining a bearing [which] that is mounted between the carrier 210 and the sustaining portion 471, a fixed disk 472 that is fixed to the hub shaft 410, and a plurality of spacer pins 473 that [is] are fixed to the fixed disk 472 and [contacting with] contact the sustaining portion 471 through an arc groove 454 formed in the transforming disk 450.

[And the] The sustaining portion 471 is rotatable, and a [through] passage hole 471a is formed therein, in order not to hinder the rotation of the mediating portion 440.

FIG. 8 [is showing] shows a section view of the present invention according to another embodiment[, that is]. Here, the apparatus [is comprising] comprises [the] planetary gears 220 having three steps, three sun gears 231, 232, 233 [which are] engaging with each step of the planetary gears 220, and an expanded speed-change controlling portion for controlling the state of speed [to] in four states. Here, [That is to say, in case of comprising] with more than two sets of pawls, a plurality of [the] pawl-controlling rings is installed between each set of pawls. However, [But] the other elements are the same as in the previous embodiment, except that [otherwise] the shapes are appropriately changed.

As described above, according to the present invention, the [extension] number of [the] speed step levels may readily be increased [is possible, moreover], because actual control[ling] of the speed steps takes place in [the part of] the pawl-controlling portion. Accordingly, there is [are little limits] hardly any obstacle to [increase] increasing the number of speed step[s] levels. Therefore, more than four speed change steps [of speed change]are also possible.

The operation and effect of the apparatus for changing the speed of bicycles, having the above structure, according to the present invention, [are to] will now be described [as follows].

Hereinafter, three speed step[s] levels, [namely] respectively, the low speed state, mid speed state[,] and high speed state, will be described with reference to the first embodiment of the present invention shown [by the] in FIGs. 3 to 7 and FIGs. 9A to 9C.

1. Low speed state

In the low speed state, as shown in FIG. 9A, both the first and second pawls 421, 422 are [not in] outside the grooves 431, 432 of the pawl-controlling ring 430.[, that] That is, they are not engaging [with] the first and second sun gears 231, 232.

When the driven sprocket 100 rotates by the rider pedaling [a] the bicycle, the carrier 210 that [is engaging with] engages the driven sprocket 100 also rotates. Then the driving force of the carrier 210 is transferred to the hub shell 310 via the clutch means 320.

In this case, while the planetary gears 220, which [is engaging with] engage the sun gears 231, 232, rotate with the carrier 210, the planetary gears 220 are idling, because the sun gears 231, 232 are in a free state.

2. Mid speed state

In the mid speed state, the speed-change controlling portion is disposed as shown in FIG. 9B[, that] That is, when [a] the rider operates a lever (not shown), the transforming disk 450 rotates a certain degree [with] by being connected with the lever by connection means, such as a wire.

When the transforming disk 450 rotates to a certain additional degree, as [the same as] compared to the mid speed state, the pork ring 442, which is connected in the splined portion 453 of the transforming disk 450, rotates, and the pawl-controlling ring 430 also rotates. So the first pawl 421 locates to the sloping groove 431 and protrudes outward. As a result, the first pawl 421 [is engaging] engages the ratchet-teeth 231a of the first sun gear 231. [In] at this time, the second pawl 422 is protruding, but not wholly, which is preferable [for being] so that it will be sensitive to the next movement of the pawl-controlling ring 430, and also so that it [also] causes little noise.

In above described mid speed state, when the driven sprocket 100 rotates by the rider pedaling [a] the bicycle, the carrier 210, which [is engaging with] engages the driven sprocket 100, also rotates. [Then, the] The planetary gears 220 also rotate[s], but in this case[,] it is because the [teeth] tooth portion of a large diameter ([simply] i.e., a first step) [of the] planetary gear[s] 220 [is engaging with] engages the fixed first sun gear 231 by the first pawl 421, causing the planetary gears 220 to rotate faster than the carrier 210.

[And the] The speed ratio (calculated by the number of gear teeth) of the mid speed state is as follows in the case [that] where the rotational speed of the carrier 210 is unity:

$$\text{speed ratio} = 1 + \frac{\text{first step of planetary gears}}{\text{ring gear}} \times \frac{\text{first sun gear}}{\text{first step of planetary gears}}$$
$$= 1 + \frac{\text{first sun gear}}{\text{ring gear}}$$

In this embodiment, the [increase of] speed is about one and a half times that of the low speed state.

As a result, the rotational speed of the ring gear 240_1 by the rotation of the planetary gears 220_1 exceeds the speed of the carrier 210, and the clutch means 320 [makes] causes only [a] the faster [part to transfer the] part of the rotation to transfer to the hub shell 310.

3. High speed state

While in [In] the above mid speed state, [when a] the rider may operate[s] a lever[,] to cause the transforming disk 450 to rotate[s], as shown in FIG. 9C[, that]. This is the high speed state.

When the transforming disk 450 rotates a certain degree, as [the same as] in the mid speed state, the pork ring 442, which is connected in the splined portion 453 of the transforming disk 450, rotates, and the pawl-controlling ring 430 [also] rotates [more] further.

So the first pawl 421 moves toward the inner position of the pawl-positioning portion 411 of the hub shaft 410, and the second pawl 422 is located to the angular groove 432 and [protruding] protrudes outward. As a result, the second pawl 422 engages [with] the ratchet teeth 232a of the second sun gear 232.

In above described high speed state, when the driven sprocket 100 rotates by the rider pedaling [a] the bicycle, the carrier 210 that [is engaging with] engages the driven sprocket 100 also rotates. [Then the] The planetary gears 220 also rotate, but in this case[,] it is because the [teeth] tooth portion of a small diameter ([simply] i.e., a second step) [f the] planetary gear[s] 220 [is engaging with] engages the fixed second sun gear 232 by the second pawl 422[, the]. The planetary gears 220 rotate faster than the carrier 210, similarly to the mid speed state.

[And the] The speed ratio (calculated by the number of gear teeth) of the high speed state is as follows in the case [that] where the rotational speed of the carrier 210 is unity:

$$\text{speed ratio} = 1 + \frac{\text{first step of planetary gears}}{\text{ring gear}} \times \frac{\text{second sun gear}}{\text{second step of planetary gears}}$$

In this embodiment, the [increase of] speed is about two times that of the low speed state.

As a result, similarly to the mid speed state, the rotational speed of the ring gear 240 by the rotation of the planetary gears 220 exceeds the speed of the carrier 210, and the clutch means 320 [makes] causes only [a] the faster [part to transfer the] part of the rotation to transfer to the hub shell 310.

According to the second embodiment, as described above, three sets of pawls 421, 422, 423 are provided, so higher speed states [including] in addition to the low, mid, and high speed state[s] [is] are possible.

FIG. 10 [is showing] shows a sectional view of the present invention according to the third embodiment. The entire construction of this embodiment is [about] approximately the same as the previous embodiments.

But the direction of the installation of the planetary gears 220 is opposite to that of the previous embodiment. [And a] A first pawl 321 is installed in the space [set] created by the change of [the] direction of the planetary gears 220, and a ring gear portion 322 [formed] in the inner circumference of the hub shell 310 [are] is used as the clutch means (320 in FIGs. 3 and 8).

[And a] Here, also, a pin 444 fixed on the one side of the pawl-controlling ring 430 is used[,]. [and the] The pin 444 is connected to the transforming disk 450 through a disk 443 installed between the pawl-controlling ring 430 and the transforming disk 450. (Also, the disk 443 supports the bearing 50 as shown in FIG. 10.)

The first pawl 321 engages [with] the ring gear portion 322 by the operation of a spring 321a mounted on [a] the shaft of the planetary gears 220.

Therefore, the rotational force of the driven sprocket 100 is transferred to the hub shell 310 [with] by engagement of the first pawl 321 and the ring gear portion 322, regardless of the speed state[s].

FIG. 11 [is showing] shows a sectional view of the present invention according to the fourth embodiment. In this embodiment, the construction is similar to the third embodiment, in that[,] the direction of the installation of the planetary gears 220 is opposite to that of the [previous] first and second embodiments, [and] but a second pawl 323 installed in the space [set] created by the change of the direction of the planetary gears 220 is used as the clutch means 320.

[And] Here, also, a ring gear 242 [engaged with] engaging the planetary gears 220 and the second pawl 323, at the same time, [are] is installed outside of the second pawl 323[, and a]. A third pawl 324 is installed between the ring gear 242 and the hub shell 310.

Other elements are the same as the third embodiment.

Therefore, in the low speed state, the rotational force of the driven sprocket 100 is transferred to the hub shell 310 [with] by the engagement of the second pawl 323 and the ring gear 242 via the third pawl 324. [And in] In the mid speed state and the high speed state, the rotational force of the driven sprocket 100 is transferred to the hub shell 310 [with] by the engagement of the planetary gears 220 via the ring gear 242 and the third pawl 324.

Even in the mid speed state and the high speed state, the second pawl 323 [also engages] tends to engage the ring gear 242, but actual engagement does not take place because the rotation of the planetary gear 220 is faster than the driven sprocket 100.

The words used in this Specification to describe the invention and its various embodiments are to be understood not only in the sense of their commonly defined meanings, but also to include, by special definition in this Specification, structures, materials or acts beyond the scope of the commonly defined meanings. Thus if an element can be understood in the context of this Specification as including more than one meaning, then its use in a claim must be understood as being generic to all possible meanings supported by the Specification and by the word itself.

The definitions of the words or elements of the following claims, therefore, include not only the combination of elements which are literally set forth, but all equivalent structures, materials or acts for performing substantially the same function in substantially the same way to obtain substantially the same result.

Insubstantial departures from the claimed subject matter as viewed by a person with ordinary skill in the art, now known or later devised, are expressly contemplated as being equivalently within the scope of the claims, even though not performing exactly the same function in substantially the same way to obtain substantially the same result. Therefore, substitutions now or later known to one with ordinary skill in the art will be within the scope of the defined elements.

The claims are thus understood to include what is specifically illustrated and described above, what is conceptually equivalent, what can be obviously substituted and also what essentially incorporates the essential idea of the invention.

[Industrial Applicability

As described above, the apparatus for changing the speed of bicycles of the present invention, as a transmission for bicycles and something using sprocket and chain, changes speed of bicycles using inner gears inside a rear wheel hub and controlling the inner gears with controllers mounted on a hub shaft, so that the bicycle has good appearance, the manipulation of changing speed is convenient, the effect of the manipulation takes place immediately, little noises occur when changing the speed of bicycles, and the steps of speed are easily extensible.]